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# Why do Firms reimburse Job Applicants' Relocation Costs?

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# Why do firms reimburse job applicants' relocation costs?

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# Why do firms reimburse job applicants' relocation costs?

*Abstract: We develop an equilibrium job search model in which employees incur commuting costs, and residential relocation is costly. We demonstrate that firms partially compensate workers for the incurred relocation costs to avoid paying compensation for commuting costs.*

## 1. Introduction

The relationship between residential mobility and residential relocation costs has extensively been investigated (see, among others, Boehm, 1981; Englund, 1986; Lundborg and Skedinger, 1999 and Pinto, 2002). Far less attention has been given to the implications of firms' recruitment policies for residential moving behaviour. In the current paper, we aim to explain the empirical observation that many private and public firms reimburse residential relocation costs. In the United Kingdom, 22% of managerial/professional employees receive a contribution to relocation expenses at the moment of recruitment (RCI, 2001). Although we do not have such detailed information for other countries, anecdotal evidence suggests reimbursement of relocation expenses is universal.

This raises the question why firms reimburse residential relocation costs? Such a question is relevant from a theoretical and a policy point of view. From a theoretical perspective, reimbursement of residential relocation costs is interesting, because it induces employees to reduce the journey to work. From a policy perspective, reimbursement is relevant for two reasons. First, reimbursement of residential moving costs affects the effectiveness of transport policies. Second, reimbursement of residential relocation costs is sometimes treated as taxable income, when it exceeds a threshold (in the Netherlands, shipping costs plus 5445 EUR or 12% of annual income). Presumably, such a threshold is imposed to avoid tax evasion (i.e. firms pay wages by means of reimbursements). Nevertheless, since we will demonstrate that firms reimburse residential relocation costs for efficiency reasons, it will be inefficient to impose such a low threshold. Taxing reimbursement would therefore increase average commuting costs, reduce the probability of a match, and increase unemployment.

The current paper aims to address reimbursement of relocation costs by developing a commuting model which explicitly takes labour market imperfections and wage bargaining between workers and employers into account. More generally, the current paper can be interpreted as an attempt to understand commuting behaviour from a job search perspective. Job search theory is currently the main theoretical and empirical framework to analyse labour markets, building on the work of Stigler (1961, 1962). Search theory allows for market imperfections (lack of information, moving costs), and therefore avoids the problems associated with the standard urban economics model which assumes that markets are perfect (see Anas, 1982; Hamilton, 1982, 1989). The current study makes use of an equilibrium search model, also referred to as a job matching

model. Search behaviour of job seekers and employers are both explicitly modelled and commuting costs, wages, number of unemployed and number of vacancies are endogenously determined.

The outline of the current paper is as follows. In section 2 we introduce an equilibrium job search model, which includes commuting, but excludes residential moving behaviour. In section 3, we extend the model by including residential moving behaviour and relocation costs. Section 4 focuses on implications of the model. Section 5 concludes.

## 2. The basic job matching model

### 2.1 The job matching function

We presume a continuum of identical firms and residences, which are homogeneously distributed over a two-dimensional space, so spatial variation in house prices is absent. The economy is closed. Each residence is inhabited by one individual, who is either unemployed or employed. The unemployed search for jobs, the employed do not search (for an equilibrium model which includes on-the-job search, see Mortensen, 1994). The employed incur commuting costs  $t$ , where  $t$  includes both monetary and travel time costs. The unemployed search throughout geographical space, facing a density of commuting costs  $g(t)$ . The commuting costs become known at the moment the unemployed job seeker and firm contact each other. A firm consists of only one job, which is either filled or unfilled. In order to fill a job, firms post a vacancy.

Initially, we presume that workers do not move residence, because residential relocation costs are infinite, and unemployed pay job entry costs  $d$  at the moment of becoming employed. Job entry costs include the purchase of new clothing or equipment, and the costs of adjusting to the new environment, tasks and colleagues (Burgess, 1992). The reason we introduce job entry costs is not so much its empirical relevance (Burgess, 1992), but it is mainly to facilitate derivation and interpretation of the results when we analyse residential relocation costs in section 3. For a partial equilibrium analysis of job entry costs and job mobility, see, among others, Burgess, 1992 and Van den Berg, 1992.

Suppose there are  $L$  identical individuals in the labour force. We let  $u$  denote the unemployment rate and  $v$  denote the vacancy rate, defined as number of vacant jobs as a fraction of the labour force  $L$ . We assume the existence of a matching function that gives the number of contacts between unemployed and firms as a function of the number of unemployed  $uL$  looking for jobs and the number of firms looking for workers  $vL$ . The number of contacts taking place per unit of time is given by  $mL = m(uL, vL)$ . The matching function is assumed increasing in both its arguments, concave, and has constant returns to scale. Empirical studies generally accept the assumption of an aggregate matching function with constant returns to scale, see Petrongolo and Pissarides (2001).

Given the matching function, the probability for a vacancy to be contacted per unit of time, denoted as  $q$ , is defined. Given the constant returns to scale assumption, it follows that

$$q = \frac{m(uL, vL)}{vL} = m\left(\frac{u}{v}, 1\right) = m\left(\frac{1}{\theta}, 1\right),$$

where  $\theta = v/u$ . So,  $\theta$  is a measure of labour market tightness, defined as the ratio of the vacancy to the unemployment rate. Thus,  $q$ , the rate at which vacancies become contacted, depends negatively on the ratio of the vacancy to the unemployment rate,  $\theta$ , and to emphasise this, we will denote the vacancy contact rate as  $q(\theta)$ . Similarly, it can be seen that the rate at which unemployed become contacted equals  $\theta q(\theta)$ , where  $\theta q(\theta)$  depends positively on  $\theta$ .

## 2.2 Employed and Unemployed

An individual receives a wage  $w$  and incurs commuting costs  $t$  when employed, and receives unemployment benefits  $z$  when unemployed. The unemployed pay job entry costs  $d$  when moving into employment. When employed, the commuting costs are exogenous to the worker. In contrast, the wage is endogenous. Given the value of the commuting costs  $t$ , firm and unemployed will bargain about the wage  $w$ , so  $w = w(t)$ . The worker will not keep the job forever. The job will be destroyed at rate  $\lambda$  and the worker will then become unemployed. The discount rate is denoted as  $r$ .

We denote by  $U$  and  $W(t)$  the expected (discounted) lifetime income of the unemployed and employed respectively. The lifetime income of the employed can be written as:

$$rW(t) = w(t) - t + \lambda(U - W(t)). \quad (1)$$

The lifetime income of the employed is equal to the sum of the net wage - the wage minus the commuting costs - and the expected change in lifetime income due to the probability of losing the job. We will show later on that  $w(t) - t$  is decreasing in  $t$ . This implies that also  $W(t)$  is decreasing in  $t$ .

When firms and unemployed contact each other, the commuting costs become known and they will form a match when  $W(t) > U + d$ . There exists a maximum acceptable commuting cost  $T$ , called the reservation commuting costs, at which the unemployed (and the firm) is indifferent between forming a match or continuing searching (for a proof see section 2.5). It follows that only jobs incurring commuting costs less than  $T$  are accepted. The fraction of acceptable jobs can be written as:

$$\int_0^T g(t) dt = G(T) = G, \quad (2)$$

where  $g(t)$  is the density of commuting costs. So, the unemployed become employed at rate  $G\theta q(\theta)$ . When unemployed, the job seeker does not know the value of the commuting costs, implying that the lifetime utility of the unemployed can be written as:

$$rU = z + G\theta q(\theta)(W^e - U - d), \quad (3)$$

where  $W^e$  denotes the conditional expectation of the lifetime income when employed, so  $W^e = E(W|t \leq T)$ . Interpretation of this Bellman equation is as follows: the unemployed receives benefits  $z$  and has per unit of time a probability  $G\theta q(\theta)$  of becoming employed, and expects to receive an increase in lifetime income equal to  $W^e - U - d$ .

### 2.3 Job creation

The value of a vacancy,  $V$ , can be written as:

$$rV = -pc + Gq(\theta)(J^e - V), \quad (4)$$

where  $pc$  denotes the firms' hiring costs, which are presumed to be proportional to productivity. Vacancies are filled at rate  $Gq(\theta)$  and  $J^e$  denotes the conditional expectation of the job's net worth. The value of an occupied job is equal to the productivity level, denoted as  $p$ , minus the wage,  $w(t)$ , taking into account that with probability  $\lambda$  the job will be destroyed. Hence, the value of the filled job can be written as:

$$rJ(t) = p - w(t) - \lambda J(t), \text{ or, similarly, } J(t) = \frac{p - w(t)}{r + \lambda}. \quad (5)$$

In equilibrium, all profit opportunities from new jobs are assumed to be exploited, driving rents from vacant jobs to zero, so  $V = 0$ . This equilibrium condition determines the supply of vacancies, implying that:

$$(r + \lambda)J^e = p - w^e = \frac{(r + \lambda)pc}{Gq(\theta)}, \quad (6)$$

where  $w^e$  denotes the conditional expectation of the wage. Equation (6) states that the expected net return of the job ( $p - w^e$ ) is equal to the expected capitalised value of the firm's hiring cost. This condition is usually referred to as the job creation condition (Pissarides, 2000).

### 2.4 Wage determination

Recall that the commuting costs become known at the moment the unemployed job seeker and firm contact each other. The commuting costs are a drawing from a known distribution. Given the commuting costs, the unemployed and firm bargain about the wage level, and may then accept or reject the match. In equilibrium, job matches yield a local-monopoly surplus. We assume that the total surplus, equal to the sum of the workers' surplus,  $W(t) - U - d$ , and the firms' surplus,  $J(t) - V$ , is shared according to the Nash solution to a bargaining problem, employing the following rule:

$$w(t) = \arg \max (W(t) - U - d)^\beta (J(t) - V)^{1-\beta}, \quad (7)$$

where  $\beta$  is a measure of the workers' labour strength, other than the 'threat points'  $U$  and  $V$ . It can also be interpreted as the workers' share of the total surplus. We presume that



$0 < \beta < 1$ . The first-order equation satisfies:

$$W(t) - U - d = \frac{\beta}{1 - \beta} (J(t) - V). \quad (8)$$

This equation implies that firms and workers agree on which job matches to accept, and which to reject.<sup>1</sup> The wage can then be written as (see Appendix 1):

$$w(t) = (1 - \beta)(z + t) + (1 - \beta)(r + \lambda)d + \beta p + \beta p c \theta, \quad t \leq T \quad (9)$$

where  $(r + \lambda)d$  denotes the expected capitalised value of the job entry costs. Equation (9) shows that the wage depends positively on commuting costs  $t$  and job entry costs  $d$ . Interpretation of these effects is as follows. Conditional on the commuting costs, firms and job seekers bargain about the wage. The higher the commuting costs, the smaller is the worker's surplus from the match (which is equal to  $W(t) - U - d$ ), so the worker will ask (and receive) a higher wage to be compensated. Similarly, the worker will be partially compensated for the job entry costs. The effect of the job entry costs on the wage depends on the discount rate  $r$  and the destruction rate  $\lambda$ , as the entry costs have to be paid upfront.<sup>2</sup> The worker is partially compensated for the job entry costs  $d$  by means of a higher wage, implying that the worker bears a risk, because job entry costs are paid upfront by the worker. Because workers and firms are both assumed to be risk neutral, equation (9) implies that another solution of the bargaining problem is that firms pay once  $(1 - \beta)d$  to the unemployed, and pay no compensation as part of the wage.

The equation also shows that the wage is increasing in the unemployment benefit level, the productivity level and the average hiring costs per unemployed ( $pc\theta$  is equal to the hiring costs times the number of vacancies divided by the number of unemployed and can be interpreted as the average hiring costs per unemployed). Finally, note that the current interpretation of equation (9) is partial, because  $\theta$  is an endogenous variable.

## 2.5 Reservation commuting costs

Job seekers and firms form a match when the commuting costs are less than the reservation commuting costs  $T$ . The existence of the reservation commuting costs can be easily shown.<sup>3</sup> The reservation commuting costs  $T$  can be derived by imposing that  $W(T) - U$  is equal to  $d$ , so  $J$  is equal to 0 (see (8)). The latter condition implies that (see (5)):

<sup>1</sup> In equilibrium,  $V = 0$ , so when  $J$  is less than 0,  $W - U$  is also less than  $d$ , therefore firms and job seekers agree not to form a match. In contrast, when  $J$  exceeds 0,  $W - U$  exceeds  $d$ , so firms and job seekers both agree to form a match. When  $J = 0$ , and therefore  $W - U = d$ , firm and job seeker are both indifferent to forming a match or continuing searching.

<sup>2</sup> The effect of the job entry costs on the wage is also determined by the bargaining position of the unemployed, measured by  $1 - \beta$ .

<sup>3</sup> The net wage, defined as the wage minus the commuting costs, is decreasing in the commuting costs, since  $1 - \beta < 1$  (see (9)). This implies that lifetime income  $W$  is a

$$p - w(T) = 0. \quad (10)$$

So the firm pays a wage equal to the productivity level, when the incurred commuting costs are equal to the reservation commuting costs. Using the wage equation (see (9)), the reservation commuting costs can be written as:

$$T = p - z - \frac{\beta}{1-\beta} pc\theta - (r + \lambda)d. \quad (11)$$

So, the reservation commuting costs are equal to the productivity level minus the sum of the unemployment benefits, a share of the average hiring costs per unemployed and the expected capitalised value of the job entry costs.

## 2.6 Equilibrium

In the steady state, the rate of individuals who enter unemployment,  $\lambda(1-u)$ , must be equal to the rate who would leave unemployment,  $uG\theta q(\theta)$ . So, the unemployment rate can be written as

$$u = \frac{\lambda}{\lambda + G\theta q(\theta)}. \quad (12)$$

The expected wage,  $w^e$ , can be written as:

$$w^e = (1 - \beta)(z + t^e) + \beta p + \beta pc\theta + (1 - \beta)(r + \lambda)d. \quad (13)$$

where  $t^e$  denotes the expected commuting costs and  $t^e = E(t | t \leq T) = \frac{\int_0^T tg(t)dt}{G(T)}$ .

As discussed above, the partial effect of job entry costs (so keeping labour market tightness constant) on the wage is positive as workers are partially compensated for the capitalised value of the job entry costs. In equilibrium however, an increase in the job entry costs decreases labour market tightness. This can be demonstrated by incorporating the expected wage equation (13) into the job creation condition (6):

$$(1 - \beta)(p - z - t^e - (r + \lambda)d) - \frac{(r + \lambda)pc}{Gq(\theta)} = \beta pc\theta. \quad (14)$$

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decreasing function of the commuting costs  $t$  (see (1)), which is a sufficient condition for the existence of the reservation commuting cost  $T$ .

Equation (14) can be solved uniquely for  $\theta$ .<sup>4</sup> Given  $\theta$ , the reservation commuting costs  $T$  are determined (see (11)), and given  $\theta$  and  $T$ , the equilibrium unemployment rate  $u$  is determined (12). So, the full equilibrium has been defined. The comparative statics results can be found in Table 1. Proofs can be provided along the lines of Pissarides (2000). For example, the overall effect of higher job entry costs on the expected wage can be demonstrated using Figure 1. The wage curve is an increasing function of labour market tightness, whereas the job creation curve implies a negative relationship between the wage and labour market tightness. The job creation curve does not depend on the job entry costs (see (6)), whereas the expected wage curve shifts up where the job entry costs increase (see (13)). Consequently, the overall effect of higher job entry costs is an increase in the expected wage. The negative effect on labour market tightness follows from the same figure.

### 3. The job matching model with residential moving behaviour

#### 3.1 When does a job match trigger a residential move?

We extend the equilibrium job search model by introducing *residential moves* and residential *relocation costs*, denoted as  $m$ , but we will further ignore job entry costs  $d$ , so  $d = 0$ . The worker will then either reduce the commuting costs by moving residence at the moment of recruitment, or will not move at all. We presume that the worker can freely choose the new location of the residence. It is optimal for the worker to choose a location as close as possible to the new workplace, so when workers move residence commuting costs will be reduced to zero. We will demonstrate in this section that the decision to move residence depends negatively on the residential relocation costs  $m$  and positively on the commuting costs at the moment of recruitment. Workers are partially compensated for the residential relocation costs. It will also be demonstrated that employees move residence when the commuting costs at the moment of application exceed a threshold, denoted as  $T^*$ . One of the consequences is that a contact generates a job match, either not accompanied by a residential move (when  $t \leq T^*$ ) or accompanied by a residential move (when  $t > T^*$ ).

It can be seen that  $T^*$ , defined as the minimum commuting costs which trigger a residential move, must be smaller than the reservation commuting costs  $T$ , which are defined as the maximum commuting costs when residential moves are inhibited, i.e. when residential relocation costs are infinite.<sup>5</sup>

Given the opportunity to move residence the lifetime income of the unemployed can be written as:

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<sup>4</sup> By differentiating equation (14) with respect to the reservation commuting costs, we find that two effects that  $T$  has on it, through  $t^e$  and through  $G(T)$ , cancel each other out, so the value of  $\theta$  can be shown to be independent of  $T$ , an envelope property implied by the optimality of  $T$ .

<sup>5</sup> The proof is as follows. Presume that  $T^* > T$ , so job contacts implying commuting costs between  $T^*$  and  $T$  will be rejected, whereas contacts implying commuting costs larger than  $T^*$  will lead to a job match. Such behaviour is clearly irrational, implying that  $T^* \leq T$ .

$$rU = z + \theta q(\theta)(W_m^e - U - m)H + \theta q(\theta)(W_s^e - U)(1 - H), \quad (15)$$

where  $W_m^e$  and  $W_s^e$  denote the expected lifetime income when the newly employed worker moves residence and the expected lifetime income when the worker stays in the same residence, and where  $H$  denotes the probability of moving residence, given a job contact. So,  $H = 1 - \int_0^{T^*} g(t)dt = H(T^*)$ . Let  $w_m$  and  $w_s$  denote the wage of movers and stayers respectively. It can be shown (in a similar way as equation (9)) that:

$$w_m = (1 - \beta)z + (1 - \beta)(r + \lambda)m + \beta p + \beta p c \theta, \quad t \geq T^* \quad (16)$$

$$w_s(t) = (1 - \beta)(z + t) + \beta p + \beta p c \theta, \quad t \leq T^* \quad (17)$$

Equation (16) indicates that the wage of movers does not depend on the commuting costs  $t$  at the moment of the job contact. It indicates that the firm will partially reimburse the relocation costs, and reimbursement is equal to  $(1 - \beta)(r + \lambda)m$ , where  $(r + \lambda)m$  denotes the capitalised relocation costs. Hence, firms partially compensate workers for the incurred relocation costs to avoid paying compensation for commuting costs. The interpretation of (17) is similar to the interpretation of (9).

The newly recruited worker will move residence when  $W_m - m \geq W_s$ . The value of  $T^*$  is determined by the condition  $W_m(T^*) - m = W_s(T^*)$ . Using equation (1), this condition implies that:

$$w_m - w_s(T^*) = (\lambda + r)m - T^*. \quad (18)$$

Consequently, when the employee is indifferent between moving or staying, the wage ‘premium’ received by movers equals the capitalised relocation costs minus the commuting costs. Equations (16) and (17) imply that  $w_m - w_s(T^*) = (1 - \beta)(\lambda + r)m - (1 - \beta)T^*$ . Using this result with equation (18) implies that  $w_m - w_s(T^*) = 0$ . It follows, using equation (18), that  $T^*$  can be written as:

$$T^* = (\lambda + r)m. \quad (19)$$

It appears that  $T^*$  has a straightforward interpretation.  $T^*$  is equal to the expected capitalised relocation costs and does not depend on any other endogenous or exogenous parameter of the model. Equation (18) implies that the wage of movers exceeds the wage

of stayers (see Figure 2). Equation (19) implies that the maximum observed commuting costs are an increasing function of  $\lambda$ ,  $r$  and  $m$ .<sup>6</sup>

### 3.2 Equilibrium

The equilibrium, presuming  $T^* < T$ , is characterised by the following equations:

The unemployment rate equilibrium:

$$u = \frac{\lambda}{\lambda + \theta q(\theta)}. \quad (20)$$

The job creation condition:

$$p - w^e = \frac{(r + \lambda)pc}{q(\theta)}. \quad (21)$$

The expected wage equation is defined as follows:

$$w^e = H.w_m + (1 - H)w_s^e,$$

where the expected wage of stayers,  $w_s^e$ , can be written as:

$$w_s^e = (1 - \beta)(z + t_s^e) + \beta p + \beta pc \theta.$$

Here,  $t_s^e$  denotes the expected commuting costs of stayers, and is defined as follows:

$$t_s^e = E(t \mid t \leq T^*) = \frac{\int_0^{T^*} tg(t)dt}{1 - H(T^*)}.$$

So, the expected wage can be written as:

$$w_n^e = (1 - \beta)z + \beta p + \beta pc \theta + H(1 - \beta)(r + \lambda)m + (1 - H)(1 - \beta)t_s^e. \quad (22)$$

So, the expected wage is an increasing function of  $\theta$  and  $T^*$ , and Figure 1 is still applicable.

The minimum commuting costs which trigger a residential relocation are written as:

$$T^* = (\lambda + r)m.$$

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<sup>6</sup> This suggests that in countries where residential relocation costs are high *and* job turnover is high (in the current model captured by  $\lambda$ ), commuting costs tend to be higher.

The probability of moving residence,  $H$ , equals  $1 - \int_0^{T^*} g(t)dt$ .

The equilibrium values of  $T^*$ ,  $H$  and  $t_s^e$  are easily determined and do not need more explanation. Equilibrium is essentially a triple  $(u, \theta, w^e)$  that satisfies the flow equilibrium condition (20), the job creation condition (21) and the expected wage condition (22). Equations (21) and (22) determine the expected wage rate and the ratio of vacancies to unemployment; given the ratio of vacancies to unemployment, equation (20) determines unemployment.

### 3.3 The effect of residential relocation costs

To analyse the effect of the residential relocation costs we proceed in a similar way as in section 2.6 when we analysed the effect of job entry costs. An increase in residential relocation costs increases the wage of stayers (because the expected commuting costs increase) and the wage of movers (because compensation for relocation costs increases) and therefore increases the expected wage  $w^e$ . So, in equilibrium, an increase in residential relocation costs decreases labour market tightness (see, similarly, Figure 1), and increases the unemployment rate (see (20)).

The condition  $T^* < T$  implies that  $(r + \lambda)m < p - z - \frac{\beta}{1 - \beta} pc\theta$ , see equations (19) and (11), where job entry costs  $d$  are equal to zero. If this condition is not fulfilled, irrespective of the commuting costs, workers will not move residence, because the capitalised residential relocation costs exceed the increase in lifetime utility of becoming employed (so  $W - U - m < 0$ ). Hence, when relocation costs are ‘too high’, firms will not compensate relocation costs, and job seekers and firms will not form a match when commuting costs exceed  $T$  (see section 2).

The full comparative statics results can be found in Table 2. The effects of the model including residential mobility (Table 2) are, in many cases, more precise than the model excluding residential mobility (Table 1). For example, including residential mobility, an increase in the productivity level unambiguously increases the number of vacancies, whereas, excluding residential mobility, the effect is ambiguous. See Pissarides (2000, p. 163) for a similar result when introducing stochastic job matching. The most interesting finding is that the effects on the expected commuting costs are different. Given the opportunity to move residence (i.e. relatively low relocation costs), the expected commuting costs depend merely on three parameters  $(\lambda, r, m)$  and do not depend on labour market variables such as the productivity level. In contrast, when workers do not have the opportunity to move residence (i.e. relatively high relocation costs), it is plausible that the productivity level is one of the main determinants of the expected commuting costs (see equation (11)).<sup>7</sup>

<sup>7</sup> This finding suggests that findings of commuting studies in Europe (where relocation costs are high due to transaction taxes) are difficult to generalise to the USA. For example, the current model suggests that the level of education, which is a proxy for

## 4. Implications

### 4.1 Risk neutrality

One of the implications of the model is that workers pay for the relocation costs  $m$  upfront, and are compensated by means of a higher wage equal to a share  $(1-\beta)$  of the capitalised relocation costs,  $(r+\lambda)m$ . This implies that workers bear a risk. Because workers and firms are risk neutral, an alternative equivalent solution to the wage bargaining problem is that firms pay  $(1-\beta)m$  to the relocated worker at the moment of recruitment, and pay no compensation as part of the wage. Hence, the model is neutral whether compensation is paid once upfront or spread out over time as part of the wage. We will focus here on two possible extensions.

One possible extension of the model is to assume that firms are risk neutral, whereas workers are risk averse. Such an assumption is in particular appropriate for large firms (Milgrom and Roberts, 1992). This assumption implies that (large) firms compensate relocation costs upfront. Another possible extension is to assume that workers and firms are both risk averse, combined with the assumptions that the job destruction rate is endogenously determined by the firm and to allow for search on the job (Pissarides, 2000). Although such an extension is beyond the aims of the current paper, one expects that workers (firms) are not willing to bear all the risk, due to adverse behavioural effects of firms (workers). Note that this argument cannot be deduced from the model. Finally, when once-only reimbursement payments of relocation costs are not taxed, whereas wages are, then it is plausible that workers are compensated upfront.

### 4.2 Willingness-to-pay estimates

In the transport literature, there is now a large literature on the marginal willingness to pay for commuting time, see Small (1992). This literature is based on a variety of methods to estimate the willingness to pay for commuting including hedonic wage methods. In essence, hedonic wage methods imply that the worker's wage is regressed on commuting time/distance (see for example Zax, 1991). Recently, Van Ommeren et al. (2000) reported that the hedonic wage willingness-to-pay estimates for the Netherlands are lower than when alternative estimation methods are used. In line with these findings, the current job matching model indicates that hedonic wage estimates are downward biased (estimates are closer to zero), because the hedonic wage method ignores that workers with a short commute may receive compensation for the relocation costs.<sup>8</sup>

### 4.3 Tax treatment of reimbursement of relocation costs

Taxes on fringe benefits tend to be less than taxes on wages, which gives an incentive to firms to compensate workers by means of fringe benefits (Lazear, 1998). In the Netherlands, reimbursement of relocation costs is accepted as a non-taxable fringe benefit

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productivity, should have a stronger effect on the commuting costs in Europe than in the USA.

<sup>8</sup> Note that this bias is particularly likely to occur in Europe where relocation costs are high due to high transaction taxes (up to 10 percent of the value of the residence).

under specific circumstances (e.g. the worker must have moved residence closer to the workplace) up to a low threshold. Average relocation costs (of owners) are about 3 times as high as the threshold.<sup>9</sup> So, a large share of the reimbursement of relocation costs is taxed, which increases the effective costs of relocation, and thus increases average commuting costs (see section 3).

#### **4.4 Spatial variation in house prices**

The current model has been based on the assumption that there is no spatial variation in house prices, in contrast to most of the urban economics literature (Fujita, 1999). The monocentric urban model presumes endogenous (spatially varied) house prices, but ignores relocation costs (Wasmer and Zenou, 2002). The main message of the monocentric urban model literature is that house prices fully compensate workers for commuting costs. Consider a multiregional structure where in each region employment is concentrated in the centre. Then one may expect that reimbursement of residential relocation costs does not occur (or occurs less frequently) when workers move within the same urban area, and the change in commuting costs is compensated via house prices. However, reimbursement is expected to occur when a worker moves interregionally (see Zax, 1994, for a more general view on the distinction between intraregional and interregional mobility).

#### **5. Conclusion**

We set out to analyse the effects of residential relocation costs on workers' compensation aiming to explain the stylised fact that many firms compensate residential relocation costs (RCI, 2001). We demonstrate that firms partially compensate workers for the incurred relocation costs to avoid paying compensation for commuting costs. As a result, an increase in residential relocation costs increases commuting costs and the equilibrium unemployment rate. In case that relocation costs are 'too high', firms do not compensate relocation costs, which reduces the probability of a job match, so implying a higher equilibrium unemployment rate. One of the policy implications is that treating reimbursement of relocation costs as taxable income may raise average commuting costs.

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<sup>9</sup> As mentioned in section 1, the threshold is maximally 5445 Euro. The average value of a dwelling is close to 150,000 Euro, whereas monetary relocation costs due to transaction taxes are at least 10% of the value of the dwelling.



## Appendix

Equations (6) and (8) imply that:

$$W^e - U - d = \frac{\beta}{1-\beta} \frac{pc}{q(\theta)} \quad (24)$$

whereas equations (2) and (24) imply that:

$$rU = z + \theta \frac{\beta}{1-\beta} pc. \quad (25)$$

Further, equation (1) can be rewritten as:

$$W - U = \frac{w - t - rU}{r + \lambda}. \quad (26)$$

Making use of equations (8) and (15) and the 3 above mentioned equations reveals that:

$$W - U - d = \frac{w - t - rU}{r + \lambda} - d = \frac{w - t - z - \theta \frac{\beta}{1-\beta} cp}{r + \lambda} - d = \frac{\beta}{1-\beta} \frac{p - w}{r + \lambda}. \quad (27)$$

Reordering of the last part of the equation, gives wage equation (9).

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**Table 1** Comparative Statics of a job search model excluding residential mobility

	T	$\theta$	u	v	G	$w^e$	$t^e$
$\beta$	?	-	+	?	?	+	?
p	+	+	-	?	+	+	+
z	-	-	+	?	-	?	-
r	?	-	+	?	?	?	?
$\lambda$	?	-	+	?	?	?	?
c	?	-	+	?	?	?	?
d	?	-	+	?	?	+	?

Note: + = positive; - = negative; ? = ambiguous

**Table 2** Comparative Statics of a job search model including residential mobility

	T*	$\theta$	u	v	H	$w^e$	$t^e$
$\beta$	0	-	+	-	0	+	0
p	0	+	-	+	0	+	0
z	0	-	+	-	0	+	0
r	+	-	+	+	-	?	+
$\lambda$	+	-	-	?	-	?	+
c	0	-	+	-	0	?	0
m	+	-	+	-	-	+	+

Note: + = positive; - = negative; ? = ambiguous

Figure 1 Wages and labour market tightness

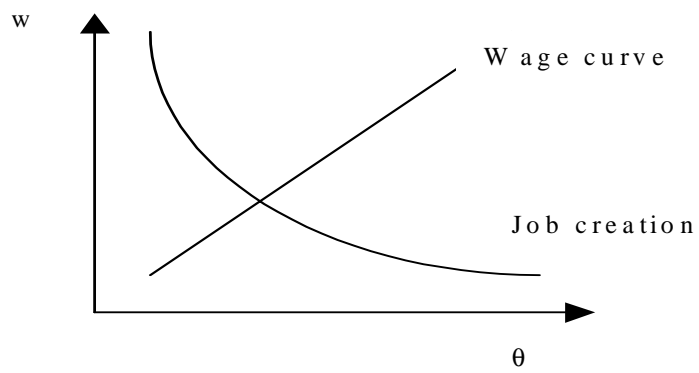


Figure 2 Wages of movers and stayers as a function of commuting costs

